CACTUS

STRENGTHENING CENTRAL AND EASTERN EUROPEAN CLIMATE TARGETS THROUGH ENERGY SUFFICIENCY

How to make the energy transition easier? The role of energy sufficiency in Lithuania

Supported by:

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

European Climate Initiative EUKI

based on a decision of the German Bundestag

How to make energy transition easier? The role of energy sufficiency in Lithuania

Prepared as part of the EUKI project "Consolidating Ambitious Climate Targets with End-Use Sufficiency" (CACTUS)

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CACTUS is a project on energy sufficiency and its integration into climate and energy strategies in the Central and Eastern European context funded by the European Climate Initiative EUKI.

It sensitises key scenario builders, policy makers and wider EU and climate and energy stakeholders on energy sufficiency and explores its integration in Hungarian and Lithuanian scenario models.

Since the Summer 2020, the négaWatt association has been coordinating the implementation of the Cactus project with its partners REKK, LEI and the Fraunhofer ISI, and with the financial support of the EUKI fund of the German Ministry of the Environment BMU.

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Introduction

The CACTUS project aims at strengthening climate mitigation actions in Central Eastern European countries (Lithuania and Hungary) by supporting the integration of energy sufficiency in national scenarios and policies.

Energy sufficiency aims at fulfilling everyone's need for energy services while adjusting their nature and amount in order to keep energy demand at a level which does not endanger the carrying capacity of the earth.

Responding to the aim of the CACTUS project, this policy brief on sufficiency in the national context of Lithuania presents the CACTUS project's results on the role of sufficiency in Lithuanian mitigation strategies to policy makers.

Until today, Lithuanian energy policies have been mostly focusing on the reduction of energy prices by developing production capacities of renewable energy sources (RES) as well as on the decrease of GHG emissions and the improvement of energy efficiency (EE). In addition, they have been addressing the request for the increase in competitiveness and relevant solutions for the decrease of energy poverty. However, efforts on EE have not been structural enough to counterbalance consumption trends which have resulted in the rise of final energy consumption (FEC) since 2009.

In 2019, the building sector accounted about 40% in the FEC in Lithuania. The building sector, as one of key emitting sectors, has a strong mitigation potential linked to actions on energy demand reduction.

Currently, the transport sector is the largest energy consuming sector in Lithuania. In 2019, transport sector accounted 40.9% in the total FEC. Due to a significant increase of fuel consumption transport sector has become one of the most important sources of GHG emissions. Seeking to implement GHG reduction targets, transport will be challenging sector. It is necessary not only to increase the consumption of renewable and alternative fuels but also to investigate more deeply how to promote sustainable mobility.

The first chapter of this policy brief provides a short review of energy and climate policy acts, their goals, targets and gaps in relation to energy sufficiency. The second chapter discusses the assumptions for energy sufficiency in Lithuania by presenting the trends of key energy sufficiency indicators for households and passenger transport sectors as well as final energy consumption reduction and the carbon dioxide savings due to energy sufficiency implementation. In the third chapter the further quantitative and qualitative benefits of energy sufficiency are presented. Finally, conclusions and recommendations are drawn.

1. National context and gaps

Energy sufficiency has not been integrated strategically and holistically in Lithuanian climate and energy strategies, with no questioning on the dimensioning of energy services. Its potential had also not been estimated and forecasted through scenario modelling, as the following analysis of national context and gaps shows.

Lithuanian climate and energy policy focuses on issues of the country's dependence on fossil fuels imported from unreliable and volatile markets, poorly diversified energy supply, high and variable energy prices, increasing energy demand, unsustainable energy consumption, changing climate, rising emissions, untapped potential for competitiveness, growth and employment opportunities.

Responding to them, the **National Energy Independence Strategy (NEIS)** [1] sets short- to long-term goals, the **Lithuanian National Energy and Climate Action Plan (NECP) for 2021–2030** [2] identifies the related targets and measures and the **Law on Renewable Energy Sources** [3]**,** the **Law on Energy Efficiency** [4]**,** the **Long-term Strategy for the Renovation of the National Building Stock** (draft) and the **Law on Financial Instruments for Climate Change Management** [5] describe tailored policies to achieve the sectorial targets and implement the goals.

In detail, the **NEIS** requests for improvement of EE, modernisation of energy infrastructure, low energy prices, decreasing energy expenditure (in relation to income) for citizens, smooth transition from fossil fuels to RES; while the NECP establishes ambitious targets up to 2030 (Table 1). The targets of the current NECP were based on the goals set by the Clean Energy for all European policy package.

Table 1. EU and National Energy and Climate Policy Targets [2]

Targets	EU		Lithuania	
	2020	**2030**	**2020**	**2030**
GHG emission target, %	20	40	EU level	
GHG emission target for EU-ETS, %	21	43	EU level	
GHG emission target for non-EU-ETS, %	10	30	15	9
RES target, %	20	32	23	45
RES target for transport, %	10	14	10	15
EE target, %	20	32.5	EU level	
PEC, Mtoe	1474	1273	6.5	5.4
FEC, Mtoe	N/A	956	4.3	4.5
Final energy savings, TWh (EED, Article 7)			11.67	27

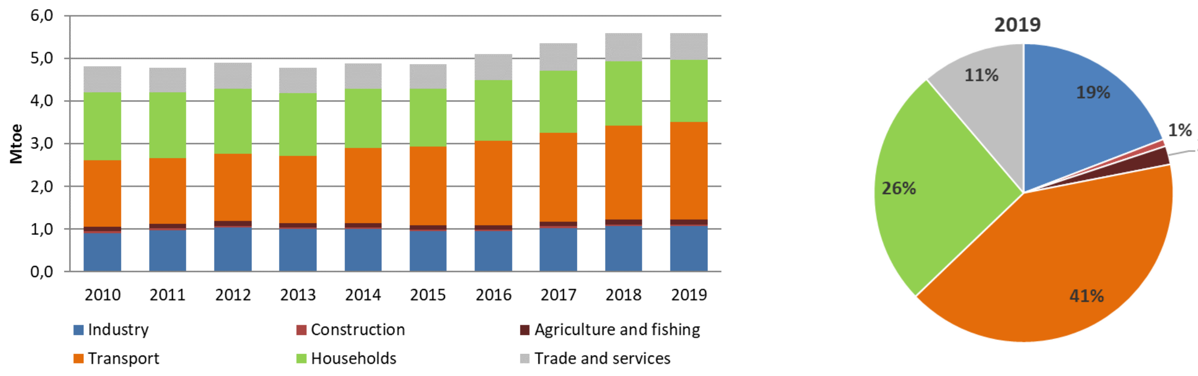
The **Law on Renewable Energy Sources** [3] requires to increase the share of energy from RES in relation to the country's total FEC to at least 50%, and the share of electricity from RES in total electricity consumption to 70% by 2030 and later on; as well as proposes promotional measures. The **Law on Energy Efficiency** [4] determines the economic sectors to consume 0.8% less energy (taking into account the average FEC during 2016-2018) each year till 2030 and 2050 and introduces a set of measures facilitating the reduction of energy consumption, including fiscal, financial, product labelling standards, as well as education and consulting measures. According to the **Long-term Strategy for the Renovation of the National Building Stock** (draft), around 2,500-3,000 buildings will be upgraded during 2020-2030 by using two instruments – the **Programme for Renovation (modernisation) of Multifamily Houses** (PoRM2H) [6] and the **Programme for EE Improvements in Public Buildings** [7].

Despite the clear ambition and political will, it is doubtful that these policies will be enough to achieve Lithuania's commitments to Europe-wide target of reducing net GHG emissions by at least 55% by 2030 and reaching climate-neutrality by 2050. Even more so in the current energy security crisis context. Energy sufficiency could be a relevant approach to facilitate reaching increased European targets for 2030 and 2050 introduced in the European Climate Law and the Fit for 55 package [8].

2. Energy sufficiency levels for 2050 and their impact on energy demand reduction

2.1. Developments of final energy consumption

FEC had a tendency to increase by 1.7% a year during 2010-2019 and accounted to 5.6 Mtoe in 2019 (2.1 Figure, a). Transport sector and households are the largest consumers. In 2019, they consumed 67% of fuel and energy (Figure 2.1., b).



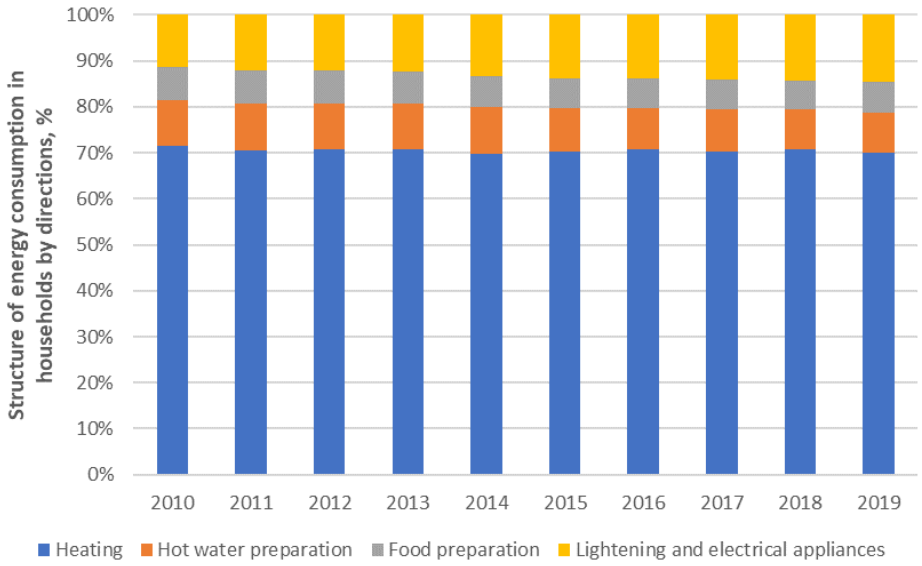
a) b)

Figure 2.1. Tendencies of final energy consumption in Lithuania during 2010-2019 (a) and its structure (b) [1]

FEC reduced in households by 1.1% a year, but it increased by 4.4% a year in transport sector. The NEIS expects to reduce energy consumption in households by 0.4% a year for the purpose to consume 1,340 ktoe in 2050. The forecasts for energy consumption in transport sector are reverse, i.e., it is considered to increase fuel consumption by 1.6% a year to consume 2,948 ktoe in 2050. As it is seen, the present developments are favorable to reach by NEIS expected reduction in fuel consumption in households, but they are too intensive to meet the objective of fuel consumption in transport sector by 2050.

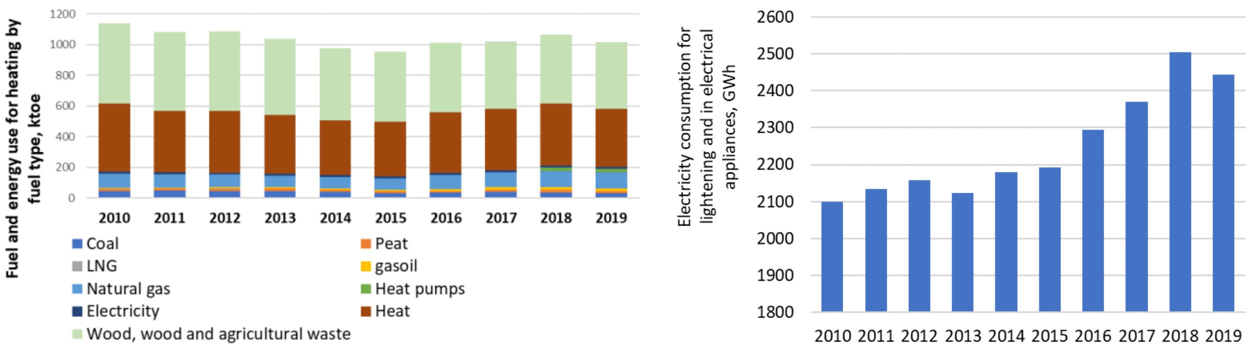
2.2. **Energy sufficiency in households**

The largest share of fuel and energy consumed in households are used for the purposes of heating (70%) and lighting and use in electrical appliances (13%) (Figure 2.2.). These are identified as key directions of fuel consumption in households with the greatest energy sufficiency potential.



2.2. Figure. Consumption of fuel and energy in households by end-use direction during 2010-2019 [1]

The structure of fuel and energy used for heating purposes is dominated by RES (firewood and wood waste) and district heat (Figure 2.3 a), but consumption of that fuels and energy reduced by 2.2% and 1.7% a year, respectively. The share of fossil fuels is around 15%, but it tends to increase due to faster use of natural gas. The demand of electricity for lighting and use in electrical appliances grows (Figure 2.3 b). It increased by about 16% during 2010-2019.



a) b)

Figure 2.3. Tendencies and structure of fuel consumption in households for the purposes of heating (a) and lighting and use in electrical appliances (b) during 2010-2019 [1]

The potential of sufficient energy consumption in households is addressed through the analysis of 9 indicators, which have been selected in the technical dialogue of the CACTUS project for their potential in terms of impact, but also because they could be easily quantified and integrated into scenario models. These are social, housing and energy indicators. Their values for the base year (2017), target and assumed levels for 2050 are summarised in Table 2.1. The expected levels for 2050 were derived through the literature, statistical data and national context analysis taking into account trends of socio-economic, demographic and other processes in the country, as well as application of econometric techniques.

Table 2.1. Selected energy sufficiency indicators for households: base year (2017), target levels and assumed levels for 2050

Indicator	Base year (2017)	Target levels for 2050	Assumed levels for 2050
Average household size, persons	2.2	2 – 4 [10]	2.2
Number of households, thousand	1,357.0	= population / avg_household_size	972.0
Number of dwellings, thousand	1,459.4	Not applicable	1,345.0
Vacancy rate, %	4	Not applicable	15
Average floor area per capita, m^2/cap	35	30 [9] – 35 [13]	32
Total floor area of dwellings, Mm^2	100.19	=avg_floor area_per dwelling x nb_dwellings	68.97 (heated)
New dwellings size, m^2	113.2	30 [9] – 35 [13]	100 (individual house), 54 (multifamily)
Average needs for hot water, toe/dw	0.09	371 kWh/cap (individual house), 294 kWh/cap (multifamily) [12]	0.06
Average needs for cooking, toe/dw	0.07	Not available	0.03

The assessed values of energy sufficiency indicators are based on the actual values [1] and projections of population provided by Eurostat [2]. The projections show that the **demographic situation deteriorates** in Lithuania and the tendency will keep up to 2050 (Figure 2.4). It deteriorates due to high emigration and natural change of population, which is being affected by declining birth rates.

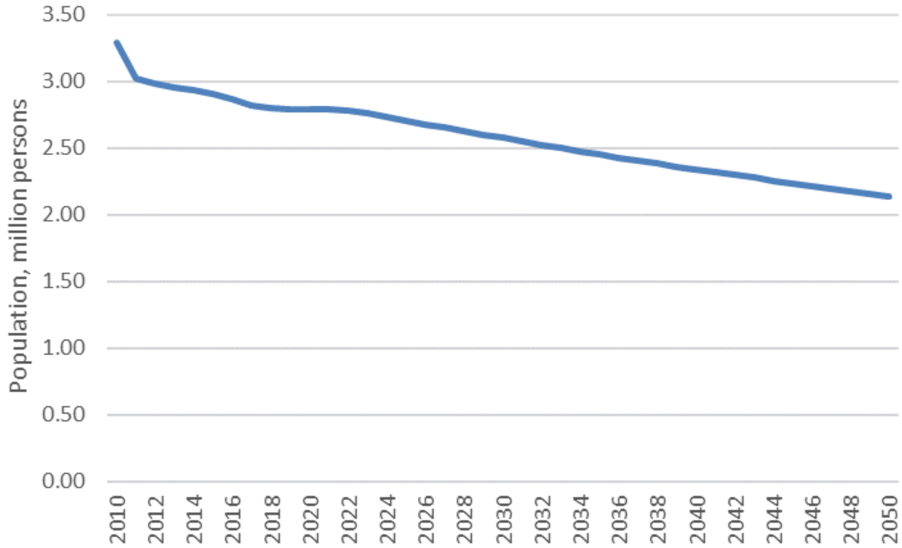


Figure 2.4. Actual values and projections of population during 2010-2050 [1], [2]

Improving living standards change living style of population, as people start living single and families without children and separately from their parents. Intergenerational living style predominated till 1990's is disappearing in the country. Thus, **the average household size (AHS) reduces,** i.e., from 2.5 (2008) to 2.2 (2018). It is expected that **due to implementation of social policies, the trend could be stabilised and 2.2 persons should make a household in 2050** (Figure 2.5).

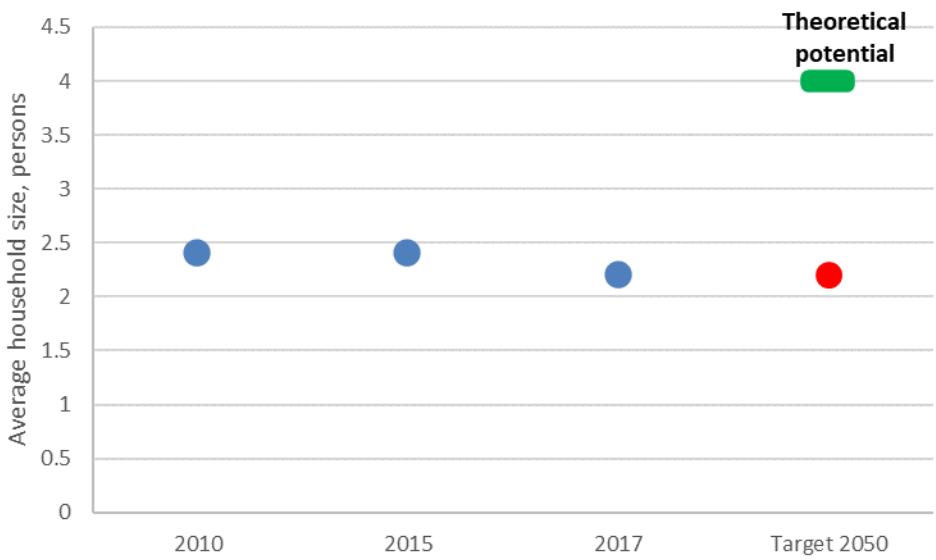


Figure 2.5. Developments in average household size till 2050

Due to the rapid decline of population in the country, **the number of households declines**. Taking into account EUROSTAT's projections of population and the estimate that a household will consists of 2.2 persons in future, **a reduction in the number of households is expected**. There will be just under 1 million households in the country in 2050.

Households are accommodated in dwellings. Historically, the number of dwellings has increased in Lithuania (Figure 2.6). There were about 1.5 million dwellings in 2017, from which 60% are detached houses. Following the dynamics of the number of households and the tendency that would be a share of households who want to have at least few dwellings, **the demand for dwellings nationwide will significantly reduce in future**. Considering the renovation plans, the historical rate of housing demolition and new construction, it is expected that **the supply of dwellings will reduce too, but will remain higher than the demand of them**.

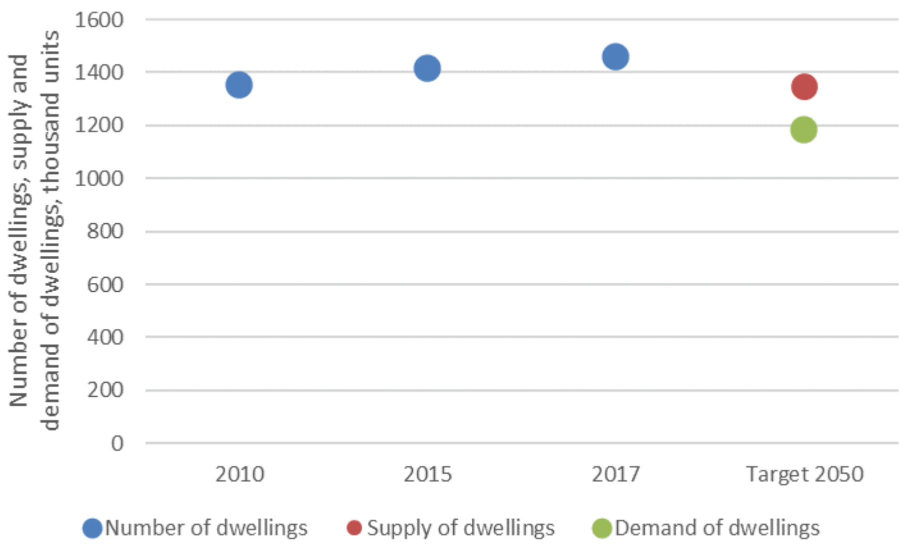


Figure 2.6. Developments in dwelling stock, its demand and supply projections till 2050

The imbalance of demand and supply of dwellings – known as **vacancy rate – is expected to increase from current 4% to 15% in 2050.** This is an unfavourable trend for energy sufficiency. From an energy sufficiency perspective, one should think about what to do with the surplus of dwelling stock, as at least part of this stock will definitely need fuel and energy to sustain.

Regardless of the size of income, there are individuals and households living in very large dwellings, such as 200 m^2 per capita, with a median dwelling floor area - 38.5 m^2 per capita. During 2010-2019, the useful floor area increased from 29.2 to 36.7 m^2 per capita. **Taking these trends into account, as well as international literature on the matter, if successful sufficiency policies were implemented in Lithuania, heated floor area could be at 32.3 m^2 per capita by 2050** (Figure 2.7).

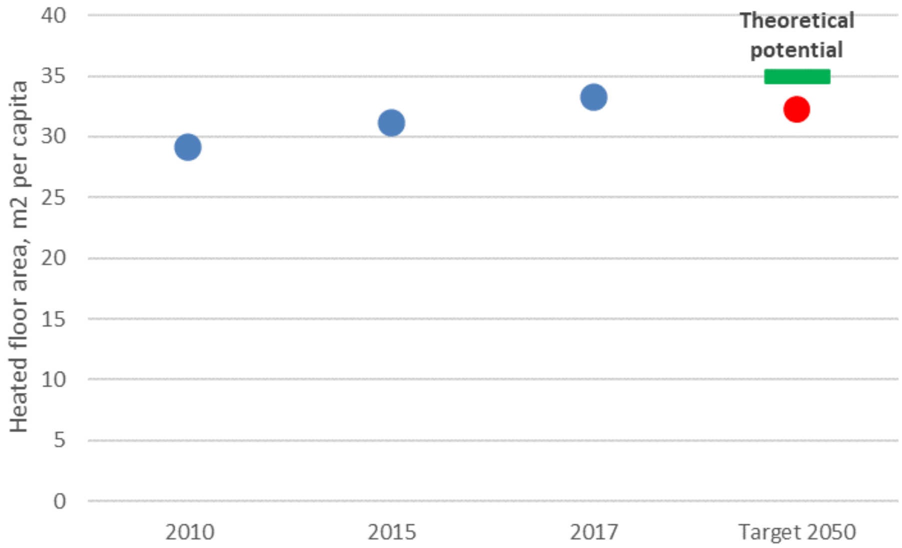


Figure 2.7. Developments in heated floor area per capita till 2050

The figure is derived taking into account an assumption that households might have several dwellings, from which the second one is not heated. Therefore, unheated floor area per capita was estimated considering useful floor area per capita and ratio of number of dwellings to households.

During 2010-2019 the average size of new dwellings decreased by 13% (or by 19.7 m²) in individual houses and by 10% (6.8 m²) in multi-apartment buildings (Figure 2.8). It is expected that the size of new dwellings will decrease in both sectors in the future. In the sector of individual houses, more houses up to 80 m² will be built as no building permission is requested. **The new dwelling size in multi-apartment building could reach 54 m².** It has been calculated taking into account the requirements of the technical building regulations regarding the minimum area of the premises and the expected size of the household.

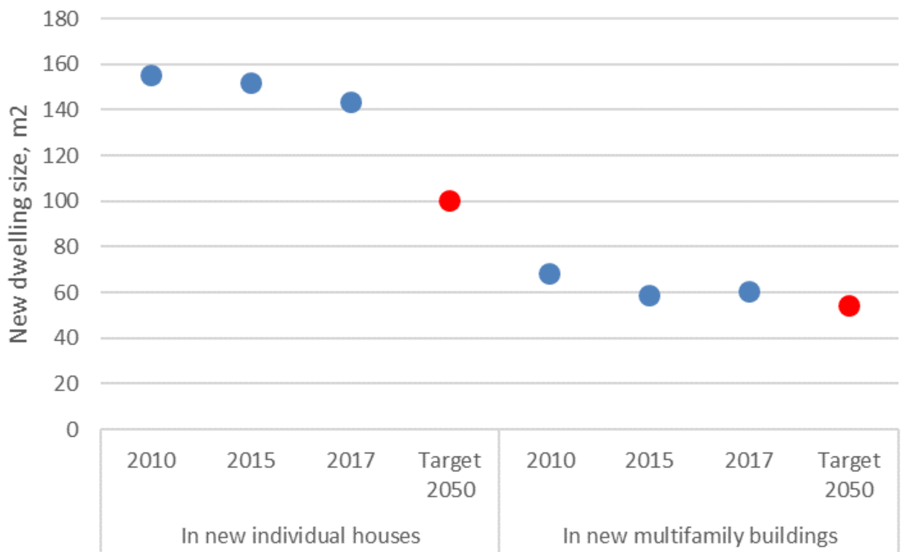


Figure 2.8. Developments in new dwelling size till 2050

If energy sufficiency approach were implemented at the above level for the 6 energy sufficiency indicators for 2050, then the **consumption of energy and fuel could decrease in households by 18.3%,** in comparison to levels assessed in one of the NEIS scenario, which takes into account measures of EE (Figure 2.9). This corresponds to expected reduction in total FEC of 3.6% in 2050.

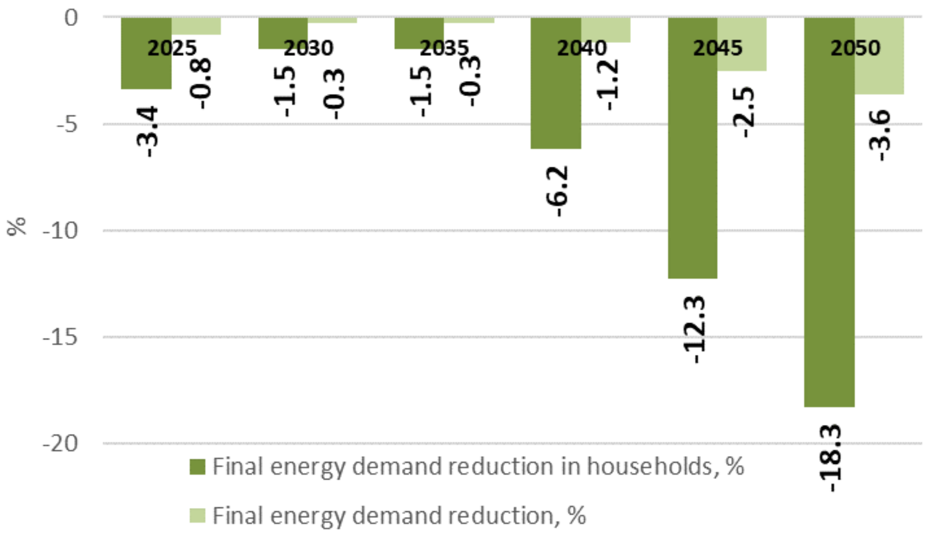


Figure 2.9. Expected reduction of FEC due to implementation of energy sufficiency in households for the 6 selected indicators up to 2050

In order to unlock this potential, sufficiency policies should be implemented. Policy measures that could be used to support energy sufficient consumption in households are summarised in Figure 2.10. The examples of best practises are provided in Figure 2.11.

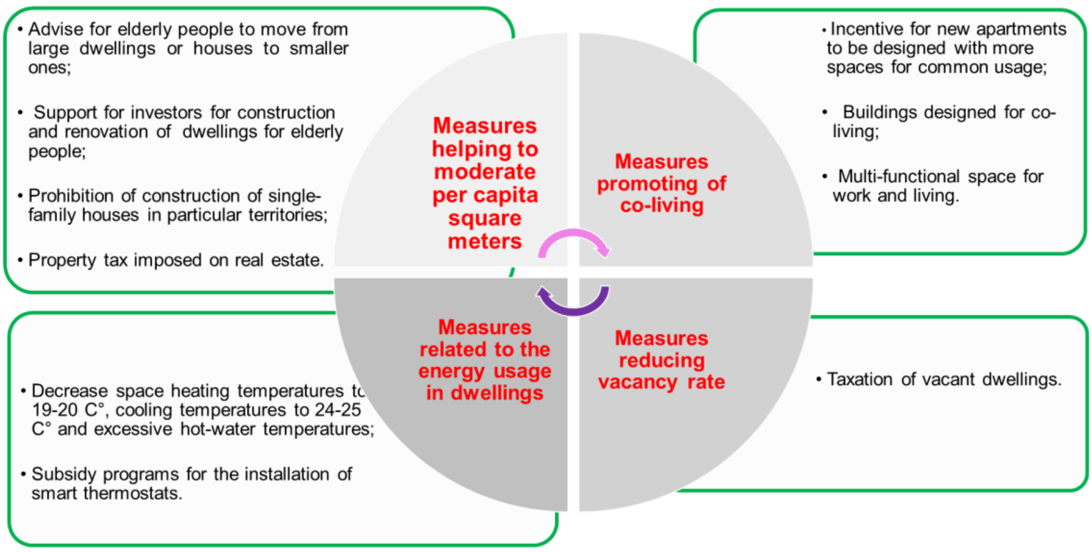


Figure 2.10. Possible measures to support energy sufficiency in households

Moderation of square meters per capita	Reduction of vacancy rate	Promotion of co-living
• In Sweden, investors who build or renovate housing for elderly people can receive support to cover a certain part of construction costs. The received support depends on the square meters and the number of planned residents. Investors get support if they adapt the common spaces of a rental apartment building or tenant-owner apartment building [14].	• Taxation on vacant buildings is implemented in France. The analysis on effect of the introduction of such fiscal policies showed that introduction of the tax was responsible of a 13% decrease in vacancy rates from 1997 to 2001 and this impact was concentrated specifically in long-term vacancy [15].	• Private investors found the business opportunity in creating buildings for co-living mostly in very popular cities like New York or Berlin where the costs of housing are very high. For example, Coconat in Berlin is a complex multi-functional space for work and living, also offering opportunities for free-time and outdoor activities [16].

Figure 2.11. Best practises of energy sufficiency measures in households

The impact of energy sufficiency measures in households on the development of the energy sector was assessed. The **mathematical modelling of energy sector development until 2050 was made**. The mathematical model used for this analysis did not model explicitly energy sufficiency measures. Therefore costs (if any) related to implementation of energy sufficiency measures were neglected. **Energy sufficiency in mathematical model was represented by exogenously given correspondingly reduced final energy demand** (Figure 2.9). Calculations were based on example of one scenario used for preparation of the current version of the NEIS. In this analyzed scenario no bounds on CO_2 emissions were applied in order to better explore impact of energy sufficiency. However, it was taken that CO_2 price increases from 52 Eur/t in 2020 until 104 Eur/t in 2030, but later it stays constant. It was found that if energy sufficiency assumptions were integrated into the energy and climate policy focused on households, **the savings of GHG emissions can be achieved by 1.2% in 2050.**

2.3. **Energy sufficiency in transport**

Fuel and energy consumption in passenger transport increases by 4.3% a year since 2011. In 2018, 1.2 Mtoe was consumed (Figure 2.12), from which 60% of fuel were consumed by cars. Diesel accounted 65% of fuel consumed in the passenger transport.

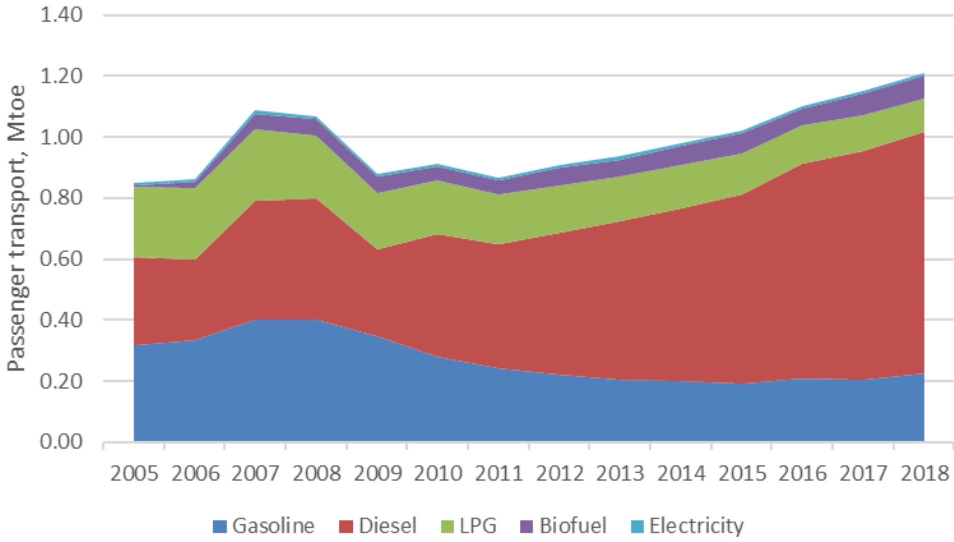


Figure 2.12. Fuel and energy consumption in passenger transport during 2005-2018

Public transport accounts about 10% of passenger transport (Figure 2.13), which is below the EU average level (16.7% in 2018).

Figure 2.13. Modal split of passender transport during 2005-2018

The potential of energy sufficiency in passenger transport has been analysed through the selection of 7 indicators, which were selected in the CACTUS technical dialogue because of their relevance and potential, but also because they could be easily quantified or integrated into models. These are travelling distances and transport mode related indicators. Their values for the base year (2017), targets and assumed levels for 2050 are summarized in Table 2.2. The expected levels for 2050 were derived in the same way as for the household.

Table 2.2. Selected energy sufficiency indicators for passenger transport: base year (2017), target levels and assumed levels for 2050

Indicator	Base year (2017)	Target levels for 2050	Assumed levels for 2050
Number of persons per car (cap/vehicle)	1.35	2 [9]-3 [10]	1.6
Number of cars per capita (vehicle/cap)	0.483	0.34 [9]	0.5
Passenger km per capita (Pkm/cap)	12208	16218 [9]; 10500 (urban), 15000 (rural) [10]	15000
Pkm by car per capita	11088	8674 [9]	11500
Pkm by bus per capita	602 (local) 367 (long-distance)	1968 [9]	1500
Pkm by rail per capita	150	1424 [9]	700
Pkm by air per capita	628	1832 [9]	1000

Since 2014 passenger travelling distances has started increasing by 5% a year. If energy sufficiency approach is implemented, still **an upward trend of total pkm per capita is expected to keep till 2050** (Figure 2.14). It is assumed that in 2050, **an individual could travel by a quarter longer distances than in 2017, i.e., 15,000 km**. However, this is by 25% less in comparison to distances forecasted by PRIMES, but still higher than average pkm in Germany today or negaWatt sufficient projections for France in 2050 Management of pkm travelled by different modes of transport (cars, buses and trolleybuses, navigation, air, and bicycle (soft mobility)) could enable extracting energy sufficiency potential in the Lithuanian passenger transport.

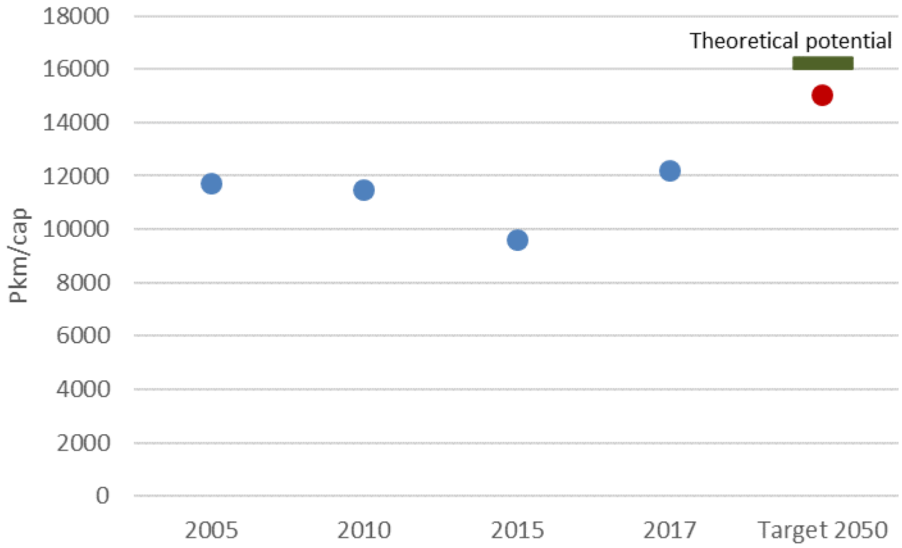


Figure 2.14. Developments in total passenger kilometres (pkm) per capita till 2050

As cars remain the main transport mode and living standards improve (number of passenger cars per person increases), **distances travelled by cars is assumed to continue to increase** (Figure 2.15) and could be stabilised at EU level in future. For this purpose, country has to encourage the use of public transport, soft mobility, car sharing, more widely introduce on line shopping or home office. The renewal and expansion of road infrastructure and commuting by car due to travelling longer distances to work as people choose living outside cities will nevertheless continue to facilitate the longer distances travelled by car.

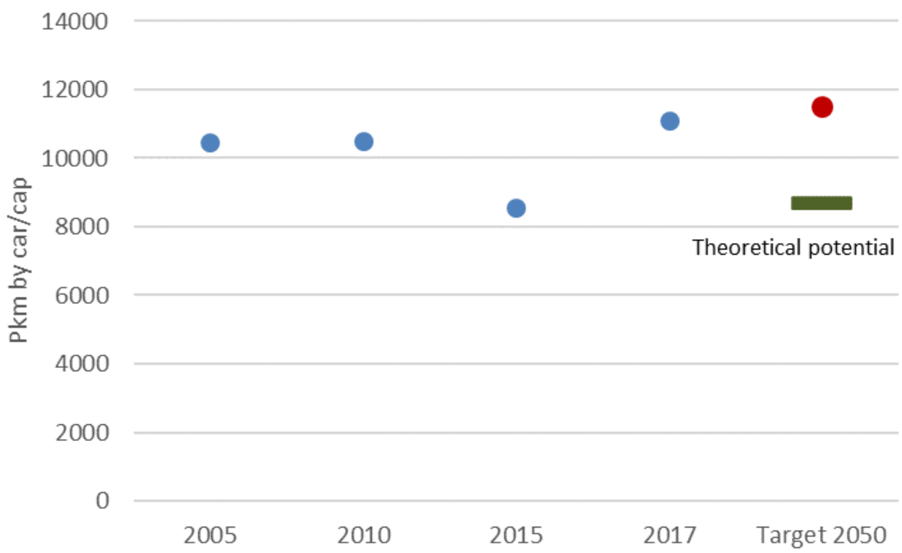


Figure 2.15. Developments in passenger kilometres (pkm) by car per capita till 2050

Passenger distances travelled by bus is assumed to increase in future (Figure 2.16). Financial support for renewal of public transport from the Programme for Climate Change, comfortable timetables and high frequency, priority lines for buses in larger cities, urban electronic tickets, smart tickets, advanced integrated ticket system for different transport modes (urban and inter-city distances), problematic search of parking for car, or ban on entering to the city center by car are relevant drivers of the public transport development.

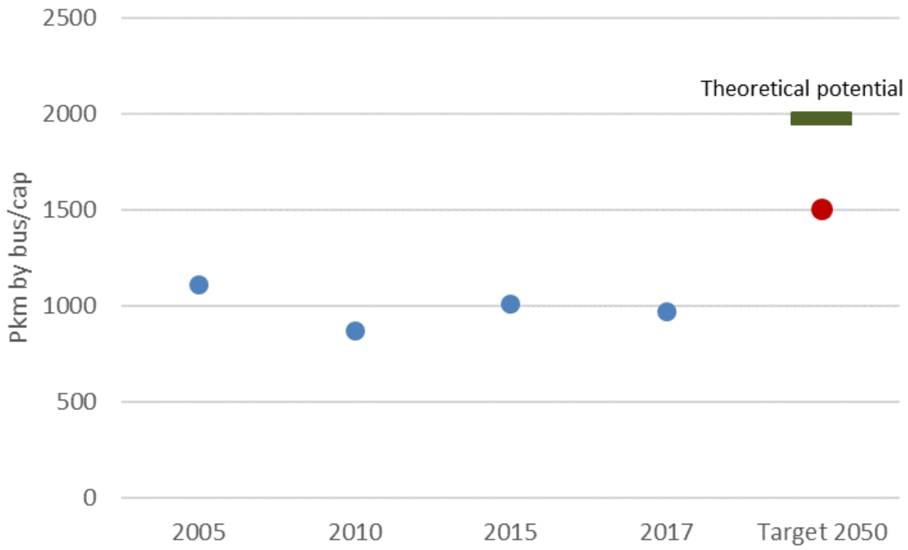


Figure 2.16. Developments in passenger kilometres (pkm) by bus per capita till 2050

Passenger distances travelled by rail will significantly increase in future (Figure 2.17) as the country takes part in the infrastructure project Rail Baltic, which should be finalized in 2026. Therefore, Warsaw, Riga and Tallin could be reached faster than travelling by plane and the number of national and international passengers will increase as high-speed trains from Kaunas / Vilnius to EU cities will be launched. Other measures could be taken to promote rail beyond 2026, including infrastructure development or ticketing.

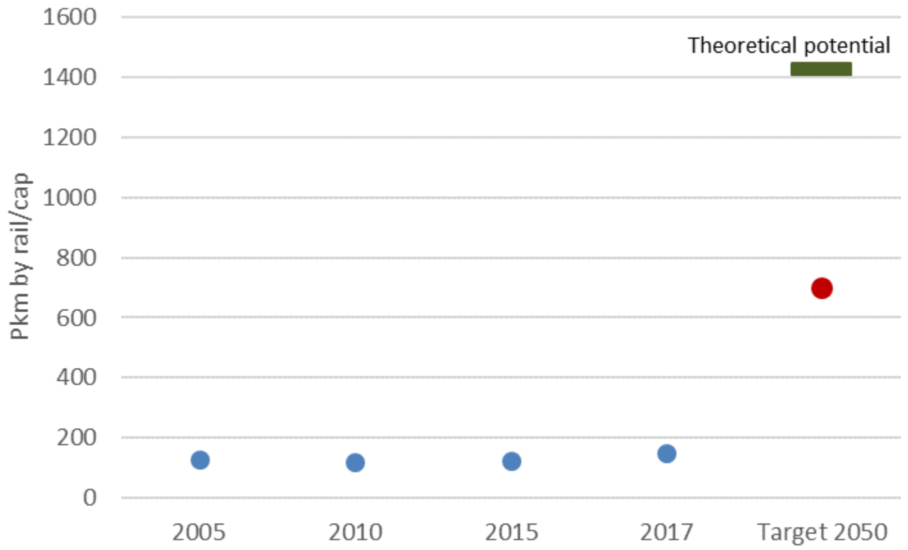


Figure 2.17. Developments in passenger kilometres (pkm) by rail per capita till 2050

Popularity and travelled **distances by soft mobility are also assumed to increase** as a result of the constant renewal of the existing bicycle path infrastructure and construction of new bicycle paths (combined with pedestrian paths) and infrastructure (parking spaces, lockers etc.).

If the implementation of energy sufficiency in passenger transport was effectively set at the level assumed for the 7 indicators, energy savings would be achieved by 2050 (Figure 2.18). It is assumed that **consumption of energy and fuel will decrease in passenger transport by 21.8%,** in comparison to levels assessed in one of the NEIS scenario, which takes into account measures of EE. This corresponds to a total expected reduction in total FEC of 8.2% in 2050.

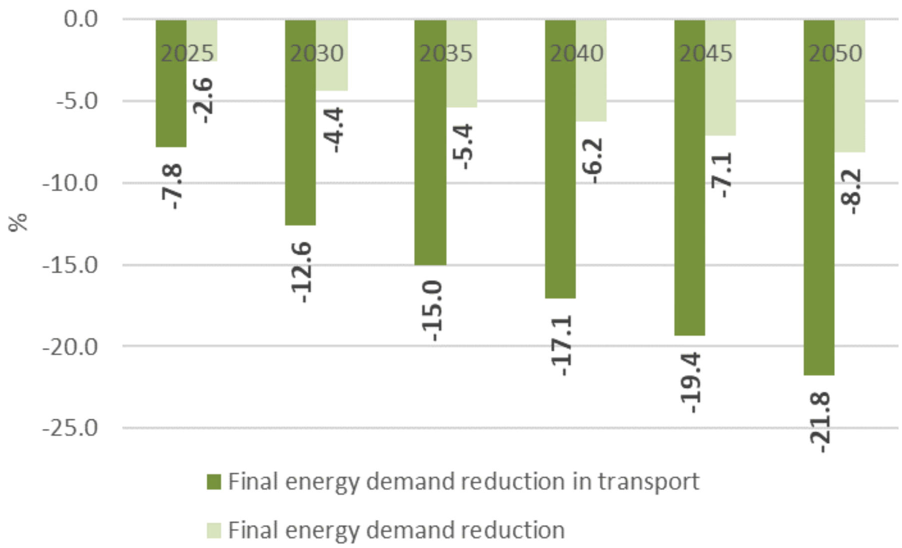


Figure 2.18. Expected reduction of final energy consumption due to implementation of energy sufficiency in passenger transport up to 2050

In order to make such savings possible, policy measures that could facilitate energy sufficiency in passenger transport are summarised in Figure 2.19. The examples of best practises of energy sufficiency measures are provided in Figure 20.

The role of sufficiency and behavioural change in achieving ambitious climate change mitigation targets is becoming well understood. **Education, awareness raising and information campaigns** becomes vitally important for successful energy sufficiency policy package.

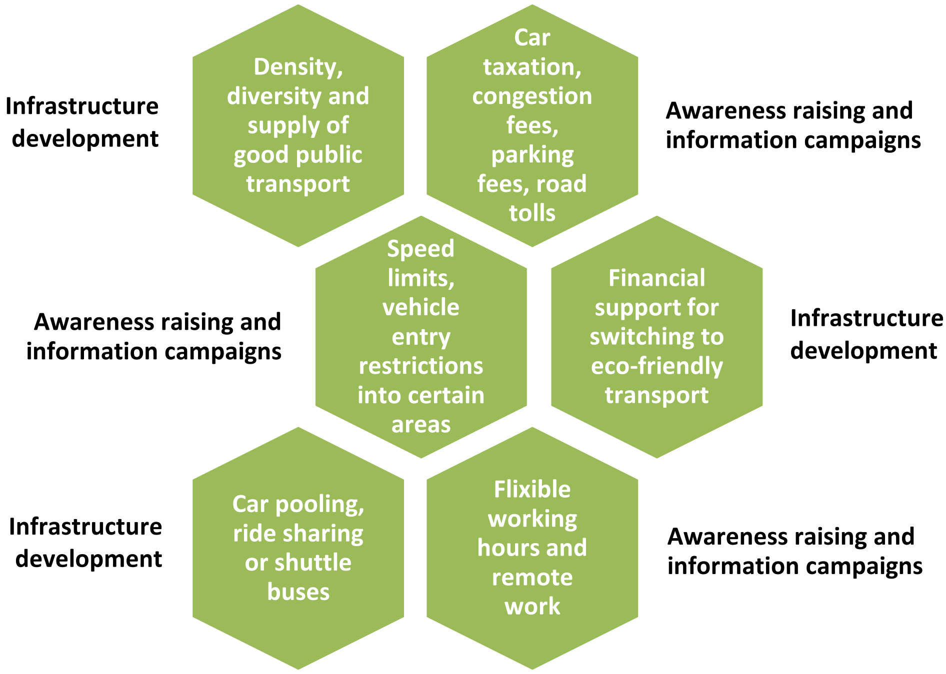


Figure 2.19. Possible measures to facilitate energy sufficiency in passenger transport

Infrastructure development	Congestion fees	Parkign pricing
• Copenhagen has an outstanding infrastructure for biking. Its bicycle network of over 400 kms includes unidirectional, protected lanes, parking places for bikes and additional design features, such as tilted garbage bins and bicycle air pumps, while the Intelligent Transport System controlling traffic lights make cycling smoother. In 2019, 28% of all trips from or in Copenhagen happened by bicycle, 21% by walking and public transport, each, while car travel made up only 30% of the trips [17].	• In London, a congestion charge has to be paid by cars entering Central London. In addition, light vehicles not meeting the prescribed emission standards (at least Euro 6 for diesels and Euro 4 for petrols) have to pay the Ultra-Low Emission Zone (ULEZ) charge, and heavy vehicles (lorries, buses) – the Low Emission Zone (LEZ) charge. These latter zones extend to the same area as the Congestion Charge Zone at the moment, but soon will be expanded [18].	• In San Francisco, parking pricing adjusts in real-time with the change of demand, to avoid cruising , i.e. driving around with the car to find free parking place, which further increase congestion and pollution and double parking (parking next to a correctly parked car illegally). Car traffic in areas with dynamic parking pricing decreased after its introduction [19].

Figure 2.20. Best practises of energy sufficiency measures in passenger transport

Finally, the impact of energy sufficiency measures for passenger transport on the development of the energy sector until 2050 was assessed by applying the same mathematical model and its key assumptions, which were taken to evaluate the impacts of energy sufficiency measure for households. Energy sufficiency-based scenario showed reductions in consumption of oil products and other fossil fuel due to energy sufficiency in passenger transport sector. If energy sufficiency assumptions were integrated into the energy and climate policy focused on passenger transport, **savings of GHG emissions can be achieved by 20.8% in 2050.**

3. Further quantitative and qualitative benefits of energy sufficiency

Energy sufficiency driven reduction of final energy consumption **leads not only to reduction of dependence of fossil fuel and GHG emissions but as well to various other benefits, some of which overlap with the positive impacts of energy efficiency**.

Quantitative direct effects include avoidance of air, soil and water pollution, decrease of the need for investment in energy systems, including electricity and heat generating assets, transmission capacity and other related infrastructure, decline of consumer costs through reduced household energy bills and fuel costs. Nonetheless, seeking to achieve energy sufficiency policy goals, other types of investments may be needed, e.g., in the case of transport, achieving lower private car use presupposes the existence of adequate infrastructure.

The **qualitative effects** of energy sufficiency will be observed too. The pattern of households' income distribution may change in directions from satisfaction of physiological needs to assurance of higher-level needs, including, self-actualisation. Due to faster climbing of the Moslow pyramid [20] up, the pattern of time use will change to in favour of more time spend for development of creativity, cognition of world and country, etc. Due to development of the sharing economy, the sense of commonality will grow stronger among residents, people will communicate more, neighbourhoods, green areas and common areas will become more liveable. Due to common use of appliances or machines, which can be kept in common spaces, the noise in dwellings will reduce too. **More generally, this contributes to increasing the resilience of societies, which is particularly relevant in the current context.**

4. Conclusions and recommendations

The policy brief identifies key pillars of energy and climate policy in Lithuania and discloses its gaps in relation to energy sufficiency. In particular, energy sufficiency and its assumptions are not well described and included in Lithuanian energy and climate policy which is strongly based on development of RES, improvement of EE, phase out of fossil fuels and reduction of GHG emissions. Furthermore, it presents the developments of key energy sufficiency indicators of Lithuanian households and passenger transport and shows relevant energy sufficiency potentials, which could be extracted by stabilising and transforming the trends of energy sufficiency indicators. This includes indicators related to building stock, use of heat, specific electricity consumption, equipment uses and travelling needs. Policy makers are introduced with possible relevant policy measures for implementation of energy sufficiency, based on good practices. Possible savings of CO_2 emissions are assessed, taking into consideration FEC reduction due to energy sufficiency in households and passenger transport.

Considering the results of the analysis of national context and gaps, the analysis of developments of energy consumption in households and passenger transport due to implementation of energy sufficiency in those sectors and the outcomes of energy sector development modelling until 2050, **it is appropriate to recommend policy makers to consider the introduction of energy sufficiency as a supplemented pillar of energy and climate policy in Lithuania in a path towards climate-neutral Europe up to 2050**.

A systematic integration of the energy sufficiency concept in all sectors of the economy can lead to significant reductions in energy demand, e.g., **the French NegaWatt scenario showed that energy sufficiency could enable a reduction of the FEC by 23% in 2050 compared to 2020, which is significantly higher than the results of the modelling of the 16 sufficiency indicators in the two Lithuanian sectors**. In France sufficiency is now integrated in the national energy and climate legislative framework, as a key lever, next to efficiency, to enable the achievement of the national target of -50% reduction in FEC by 2050 compared to 2012 level.

The concept of energy sufficiency should be systematically integrated into national energy and climate policy covering all economic sectors.

Data table list

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